

**Inventory of Butterflies
at
Fort Union Trading Post
and
Knife River Indian Villages
National Historic Sites in 2004**

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Final Report

Submitted by:

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Submitted to:

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Executive Summary

This document reports inventory of butterflies at Knife River Indian Villages National Historic Site (NHS) and Fort Union Trading Post NHS, both administered by the National Park Service in the state of North Dakota. Field work consisted of strategically timed visits throughout Summer 2004. The inventory employed “checklist” counting based on the author's experience with habitat for the various species expected from each site.

This report is written in two separate parts, one for each site. Each part contains an annotated species list for that site. For possible later GIS use, noteworthy species encounters are reported by UTM coordinates, all of which are provided conveniently in a table within the report narrative for each site. An annotated listing is also included for each species at each site. Each of these provides a brief description of typical habitat, principal larval host(s), and information on adult phenology. This information is followed by abbreviated citations for published works in which more detailed information may be located.

Recommendations are then made for each site on the basis of endemism, prairie butterfly conservation and management guidelines, and the specific ecological needs of encountered species. Three problems were noted for Fort Union Trading Post, namely that there is a history of overuse in the area of the Bodmer Overlook, that management of the prairie immediately surrounding the fort is designed to produce a “monocot monoculture” that in the long run will be unable to support breeding populations of most native prairie butterflies in the region, and intermittent natural flooding of nearly all of the woodland habitat precludes any likelihood of establishing or conserving populations of any woodland butterflies that may be found there. At Knife River, relatively intact woodland, wetland, and native prairie habitat segments were identified, principally in the northern half of the site, and many expected butterfly occurrences were confirmed. However, a history of widespread burning in the southern half of the site has essentially eliminated native butterfly populations there.

Part One:
Inventory of Butterflies at Fort Union Trading Post National Historic Site in 2004

Section I -- Introduction and Methods

General Introduction -- Field work consisted of strategically timed field visits from June through August 2004. Each survey stop within this context was chosen specifically to target situations representing "probable best habitat" in the area. The method used for determining "probable best habitat" was based on the author's experience with the various species expected from the site (once on site the target species were actively "hunted").

This report is written in three sections, *Introduction and Methods*, *Results and Discussion*, and *Recommendations to Park Management*. Section II is principally an annotated list of species encountered or otherwise documented for the site. It addresses the primary objective of providing a definitive inventory for the park unit. This information leads to the conservation observations of Section III, as they derive naturally from analysis of known ecological needs of the encountered species.

For some butterfly species, collection and preparation of voucher specimens was undertaken in order (a) to confirm occurrence formally for the record or (b) to ensure that an identification could be confirmed in the future. Voucher and repository information is given within individual accounts in the annotated list, which addresses all butterfly species, whether they were actually encountered or, although not encountered in 2004, may reasonably be expected to reproduce in the study area during a normal year.

Area Covered by this Study -- The scope of this document includes only habitats within the 444 acres of Fort Union Trading Post National Historic Site in Williams County, North Dakota. For possible later geographical information system (GIS) use, two species encounters were recorded by UTM coordinates (NAD27), and a specimen was vouchered. This information is provided conveniently in a table and within the narrative that follows.

Sampling Methodology -- Work was begun in late May, with a preliminary survey of the area to determine location and usefulness of access routes. This provided a practical picture of the logistical scope of the task.

Table 1 offers a preliminary hypothetical list of species believed at the beginning of the study might be expected at Fort Union. As noted above, the survey was structured around actually “hunting” for species on this list. The method employed was focused "checklist" searching, as defined in Royer, Austin, and Newton (1998). Timing of visits was defined by habitat and phenology information in Royer (2003), as adjusted on the basis of knowledge of the 2004 butterfly season.

Table 1. A preliminary hypothetical list of butterfly species that might reasonably be expected (on biogeographical grounds) to occur at Fort Union Trading Post NHS.

Family/Species	Source of expectation for potential breeding status
Hesperiidae	
<i>Epargyreus clarus</i>	On record in adjacent counties; possible for wooded areas
<i>Thorybes pylades</i>	On record in adjacent counties; possible for wooded areas
<i>Pyrgus communis</i>	On record in adjacent counties; possible for open prairie areas
<i>Ancyloxyopha numitor</i>	On record for Williams County; possible for wetlands or river margins
<i>Oarisma garita</i>	On record for Williams County; possible for open prairie areas
<i>Hesperia uncas</i>	On record in adjacent counties; possible for northern prairie section
<i>Hesperia comma assiniboia</i>	On record for Williams County; possible for open prairie areas
<i>Hesperia ottoe</i>	On record for Williams County; possible for northern prairie section
<i>Hesperia leonardus pawnee</i>	On record for Williams County; possible for northern prairie section
<i>Hesperia pahaska</i>	On record for Williams County; possible for northern prairie section
<i>Polites peckius</i>	On record for Williams County; possible for open prairie areas
<i>Polites themistocles</i>	On record for Williams County; possible for open prairie areas
<i>Poliotes origenes</i>	On record in adjacent counties; possible for northern prairie section
<i>Poliotes mystic</i>	On record in adjacent counties; possible for open areas
<i>Anatrytone logan</i>	On record in adjacent counties; possible for northern prairie section
<i>Poanes hobomok</i>	On record in adjacent counties; probable for woodland sections
<i>Euphyes vestris</i>	On record in adjacent counties; possible throughout park
<i>Amblyscirtes vialis</i>	On record in adjacent counties; possible in wooded sections
Papilionidae	
<i>Papilio bairdii</i>	On record in Williams County; possible for north prairie section
<i>Papilio zelicaon</i>	On record in adjacent counties; possible for northern prairie section
<i>Papilio canadensis</i>	On record in adjacent counties; possible for wooded areas
Pieridae	
<i>Pontia occidentalis</i>	On record in Williams County; possible for north prairie section
<i>Pieris rapae</i>	On record for Williams County; probable throughout park
<i>Euchloe olympia</i>	On record for Williams County; possible for open prairie areas
<i>Colias philodice</i>	On record for Williams County; probable throughout park
<i>Colias eurytheme</i>	On record for Williams County; possible throughout park
Lycaenidae	
<i>Lycaena dione</i>	On record in adjacent counties; possible for wetlands or river margins
<i>Lycaena hyllus</i>	On record in adjacent counties; possible for wetlands or river margins
<i>Lycaena hellioides</i>	On record in adjacent counties; possible for wetlands or river margins
<i>Satyrrium acadicum</i>	On record in adjacent counties; possible for willow areas

<i>Satyrrium titus</i>	On record in adjacent counties; possible for areas with <i>Prunus</i> , <i>Asclepias</i>
<i>Satyrrium liparops</i>	On record in adjacent counties; possible for wooded areas with Rosaceae
<i>Strymon melinus</i>	On record in adjacent counties; possibly occasional throughout site
<i>Celastrina ladon</i>	On record in adjacent counties; possibly occasional in wooded portions of site
<i>Glaucopsyche lygdamus</i>	On record for Williams County; possibly occasional
<i>Lycaeides melissa</i>	On record in adjacent counties; probable in prairie portions of site
<i>Plebejus saepiolus</i>	On record for Williams County; possible in native portions of site

Nymphalidae

<i>Euptoieta claudia</i>	On record in adjacent counties; probable in prairie portions of site
<i>Speyeria cybele</i>	On record in adjacent counties; probable in wooded portions of site
<i>Speyeria aphrodite</i>	On record in adjacent counties; probable in open portions of site
<i>Speyeria callippe</i>	On record in adjacent counties; possible in northern prairie section on hilltops
<i>Charidryas gorgone</i>	On record for Williams County; possible in open portions of site
<i>Charidryas acastus</i>	On record for Williams County; possible in open portions of site
<i>Phyciodes tharos</i>	On record in adjacent counties; probable in open portions of site
<i>Polygonia comma</i>	On record in adjacent counties; possible for wooded areas
<i>Polygonia progne</i>	On record in adjacent counties; possible for wooded areas
<i>Nymphalis antiopa</i>	On record in adjacent counties; possible for willow areas near river
<i>Aglais milberti</i>	On record for Williams County; possible for wooded areas
<i>Vanessa cardui</i>	On record in adjacent counties; probable in open portions of site
<i>Vanessa atalanta</i>	On record in adjacent counties; probable for wooded areas
<i>Limenitis arthemis</i>	On record in adjacent counties; possible around woodlands
<i>Limenitis archippus</i>	On record in adjacent counties; possible near willows
<i>Coenonympha inornata</i>	On record in adjacent counties; probable in prairie portions of site
<i>Cercyonis pegala</i>	On record in adjacent counties; probable in grassland portions of site
<i>Oeneis uhleri varuna</i>	On record for Williams County; possible in native prairie portions of site
<i>Danaus plexippus</i>	Migratory; possible throughout park

Section II – Results and Discussion

Summary of Encounters -- Table 2 itemizes actual species encounters in summary form. Details on all encounters are given within the separate species listing below. An inexpensive hand-held *Magellan 315* gps unit provided sufficient precision for marking encounter locations for the two noteworthy encounters (Hobomok Skipper, an eastern deciduous woodland species, and Acmon Blue, a badlands endemic not previously expected from the Ft. Union area).

Table 2. Summary of findings (including UTM coordinates for particularly significant encounters) at Ft. Union. Abundance codes are as follows: R = rare; O = occasional; UC = uncommon; FC = fairly common; C = common; VC = very common; A = abundant. They are based on frequency of encounter per survey hour.

Family/Species	Encounter Date	UTM (n)	UTM (e)	Estimated Abundance
<i>Epargyreus clarus</i>	24 June	--	--	R
<i>Oarisma garita</i>	24 June	--	--	R
<i>Poanes hobomok</i>	24 June	5316012	13_572106	R

Hesperiidae

Pieridae

<i>Colias philodice</i>	24 June, 19 July	--	--	UC, FC
<i>Colias eurytheme</i>	19 July	--	--	R

Lycaenidae

<i>Lycaeides melissa</i>	19 July	--	--	UC
<i>Icaricia acmon</i> area)	24 June	5317827	13_572550	R (actually outside study

Nymphalidae

<i>Euptoieta claudia</i>	24 June, 19 July	--	--	R, R
<i>Speyeria aphrodite</i>	19 July	--	--	R
<i>Coenonympha inornata</i>	24 June	--	--	UC
<i>Cercyonis pegala</i>	19 July	--	--	UC

Format of the Individual Listings -- In the separate listings which follow, a species is first identified on the left by its common name, after which is given its Latin name (at the binomial level unless the trinomial is pertinent), including its original author (if parenthesized, under a different genus name) and the date of original description. Under the Latin name is given the species' four-letter North Dakota Code (NDC) statewide database recording code. The NDC system consists of four-letter reporting/database codes originally derived from binomial names in Miller & Brown (1981), as amended by Ferris (1989). For example, *Colias philodice* = CPH. These codes have been employed for several years in long-term butterfly monitoring projects at a number of North Dakota sites, and for the sake of congruency with existing database material they are the preferred codes for reporting butterfly survey data in the state. The sequence of listings follows the phylogenetic arrangement used by the above authors.

After the material on naming there is a brief description of typical habitat, in some cases of adult food sources, etc. This information is followed by an indication of the principal larval host(s), where these are specifically known, and that by information on adult phenology. Abundance is noted as follows:

"Abundant" means encounter with more than 10 individuals may be expected per hour of survey time.

"Common" means more than five individuals. "Uncommon" means fewer than five but typically at least one. "Occasional" means some counts may include encounter and others not. "Rare" means regular encounter is not to be expected.

Confirmations of occurrence in the study area are based as follows: Collection of voucher specimens, observation during field visits, presumption of regular occurrence (generally on the basis of known ubiquitous local distribution), historical record, assumed likelihood of eventual discovery. For any noteworthy encounters, the location was recorded by UTM coordinates, and tables and species accounts below include that information for all encounters.

All this material is followed by abbreviated citations for published works in which more detailed information may be located. The abbreviation includes the last names of authors and the page numbers on which the main textual entries will be found. These reference works are as follows:

- Royer, Ronald Alan. 2003. *Butterflies of North Dakota: An Atlas and Guide*. Minot State University Science Monograph Number Two. (Specifically for North Dakota)
- Ferris, Clifford D. and Brown, F. Martin. 1981. *Butterflies of the Rocky Mountain States*. University of Oklahoma Press. Norman. (For principally western taxa)
- Layberry, Ross A., Hall, Peter W., and Lafontaine, J. Donald. 1998. *The Butterflies of Canada*. University of Toronto Press. Toronto. (For principally northern taxa)
- Opler, Paul A. and Krizek, George O. 1984. *Butterflies East of the Great Plains: An Illustrated Natural History*. The Johns Hopkins University Press. Baltimore. (For principally eastern taxa)
- Scott, James A. 1986. *Butterflies of North America: A Natural History and Field Guide*. Stanford University Press. Stanford, California. (For taxa of all regions)

In addition to these resources, one may also wish to consult the Northern Prairie Wildlife Research Center on-line resources titled "Atlas of North Dakota Butterflies" and "Butterflies of North America" at <<http://www.npwrc.org>>.

Finally, the listing of references is followed by a record of encounters made during the 2004 butterfly survey season and/or any historic records pertinent to the study area or nearby adjacent habitats. All records designated as "vouchered," "encountered," or "observed" refer to the above-described field surveys. What follows is an annotated list of species now known from or presumably to be discovered within Fort Union Trading Post NHS. Occurrence information occasionally includes comments on a species' ecological importance.

Hesperiidae The Skippers

Silver-Spotted Skipper

Epargyreus clarus (Cramer, 1775)

EPCL

Habitat: Sunlit wooded clearings; *Apocynum* blooms

Larval food: Wild licorice (*Glycyrrhiza lepidota*)

Adult flight: One brood in June and early July

References: Royer 14, Opler & Krizek 199, Scott 470

Confirmed occurrences: One example encountered on 24 June in open area near the parking lot. This woodland species could be fairly common in woodland clearings around Fort Union Trading Post.

Northern Cloudy Wing

Thorybes pylades (Scudder, 1870)

THPY

Habitat: Widespread in forested areas, often at *Eleagnus*, *Apocynum* blooms

Larval food: Legumes

Adult flight: Late May, June

References: Royer 15, Opler & Krizek 204, Scott 479

Confirmed occurrences: Not encountered. Under suitable ecological conditions, this species could be fairly common in woodland clearings around Fort Union Trading Post.

Dreamy Dusky Wing

Erynnis icelus (Scudder & Burgess, 1870)

ERIC

Habitat: Aspen woodlands

Larval food: *Salix*, *Populus*

Adult flight: Principally in May

References: Royer 16, Opler & Krizek 208, Scott 487

Confirmed occurrences: Not encountered. Probably does not occur in the area of Fort Union Trading Post.

Afranius Dusky Wing

Erynnis afranius (Lintner, 1878)

ERAF

Habitat: Aspen woodlands; more widespread in western counties

Larval food: *Thermopsis rhombifolia*, probably other legumes

Adult flight: Two broods, in May/June and July/August

References: Royer 19, Ferris & Brown 79, Scott 493

Confirmed occurrences: Not encountered. Probably does not occur in the area of Fort Union Trading Post.

Common Checkered Skipper

Pyrgus communis (Grote, 1872)

PYCO

Habitat: Open, dry, sunny ground

Larval food: Malvaceae

Adult flight: Spring immigrants yield at least one additional brood

References: Royer 22, Ferris & Brown 83, Scott 495

Confirmed occurrences: Not encountered. Probably does occur in some years in sunny open areas around Fort Union Trading Post.

Common Sooty Wing

Pholisora catullus (Fabricius, 1793)

PHCA

Habitat: Open spaces, bare soil, mud puddles, roadbeds

Larval food: Goosefoots and Amaranths

Adult flight: May-June and July-August

References: Royer 23, Opler & Krizek 218, Scott 498

Confirmed occurrences: Not encountered. May occur in some years in sunny open areas around Fort Union Trading Post.

Garita Skipperling

Oarisma garita (Reakirt, 1866)

OAGA

Habitat: Open mixed-grass prairie; likes legume and composite flowers

Larval food: Native prairie grasses, including *Stipa*, *Poa*, *Bouteloua*

Adult flight: One brood, Late May throughout June; approximately two weeks later during 2002

References: Royer 29, Ferris & Brown 137, Scott 431

Confirmed occurrences: One example encountered 24 June 2004 in the vicinity of Bodmer Overlook.

Probably regularly breeds in the upland prairie areas north of Fort Union Trading Post.

Uncas Skipper

Hesperia uncas (W. H. Edwards, 1878)

HEUN

Habitat: Native mid-grass to short-grass prairie hilltops

Larval food: *Bouteloua gracilis*

Adult flight: Two broods, June and August

References: Royer 31, Ferris & Brown 124, Scott 435

Confirmed occurrences: Not encountered. Probably does not occur in the area of Fort Union Trading Post.

Common Branded Skipper

Hesperia comma (Linnaeus, 1758)

HECO

Habitat: Prairie hilltops; very fond of *Liatris* blooms

Larval food: Native grasses and sedges

Adult flight: One brood, August

References: Royer 32, Ferris & Brown 125, Scott 436

Confirmed occurrences: Not encountered. Probably does occur in the upland prairie areas north of Fort Union Trading Post during late summer.

Pawnee Skipper

Hesperia leonardus pawnee Dodge, 1874

HEPW

Habitat: Undisturbed, often sandy native prairies on *Liatris* blooms

Larval food: Native grasses, especially *Bouteloua*; *Stipa*, *Poa* also mentioned in literature

Adult flight: One brood, early August

References: Royer 34, Ferris & Brown 128, Scott 438

Confirmed occurrences: Not encountered. Probably does occur in the upland prairie areas north of Fort Union Trading Post during late summer.

Pahaska Skipper

Hesperia pahaska (Leussler, 1938)

HEPA

Habitat: Shortgrass prairie, southwestern ND; often on *Cirsium* blooms

Larval food: *Bouteloua gracilis*

Adult flight: One brood, June and early July

References: Royer 35, Ferris & Brown 130, Scott 438

Confirmed occurrences: Not encountered. Probably does not occur in the area of Fort Union Trading Post.

Peck's Skipper

Polites peckius (W. Kirby, 1837)

POPE

Habitat: Meadows with higher humidity (often concentrated near water)

Larval food: Cutgrass (*Leersia oryzoides*), probably also *Poa*

Adult flight: One brood, mid-June into July

References: Royer 37, Opler & Krizek 232, Scott 444

Confirmed occurrences: Not encountered. Probably does not occur in the area of Fort Union Trading Post.

Tawny-edged Skipper

Polites themistocles (Latreille, [1824])

POTH

Habitat: Meadows and road ditches, often at alfalfa blooms

Larval food: Grasses, including *Poa*, *Panicum*

Adult flight: One brood, mid-June into July, somewhat later in 2002

References: Royer 38, Opler & Krizek 234, Scott 445

Confirmed occurrences: Not encountered. Probably does not occur in the area of Fort Union Trading Post.

Crossline Skipper

Polites origenes (Fabricius, 1793)

POOR

Habitat: Ungrazed native prairie, *Echinacea* blooms

Larval food: Reportedly Purpletop (*Tridens flavus*); probably *Andropogon* in North Dakota

Adult flight: One brood, mid-June into July; flight was approximately two weeks late in 2002

References: Royer 39, Opler & Krizek 234, Scott 446

Confirmed occurrences: Not encountered. Probably does not occur in the area of Fort Union Trading Post.

Long Dash

Polites mystic (W. H. Edwards, 1863)

POMY

Habitat: Marsh edges, wet meadows, prairies & roadside ditches

Larval food: Grasses, including *Poa*, *Agropyron*, *Phleum*

Adult flight: One brood, mid-June into July; somewhat later in 2002

References: Royer 40, Opler & Krizek 235, Scott 445

Confirmed occurrences: Not encountered. Probably does occur in the area of Fort Union Trading Post in more favorable years.

Rhesus Skipper

Polites rhesus (W. H. Edwards, 1878)

YVRH

Habitat: Rare but endemic throughout badlands; prefers bare soil, bunchgrass prairie

Larval food: *Bouteloua gracilis*

Adult flight: One brood, principally in late May

References: Royer 41, Ferris & Brown 133, Scott 434

Confirmed occurrences: Not encountered. Probably does not occur in the area of Fort Union Trading Post.

Delaware Skipper

Atrytone logan (W. H. Edwards, 1863)

ATLO

Habitat: Open grasslands; loves thistle blooms

Larval food: Grasses, including *Andropogon*, *Panicum*, *Erianthus*

Adult flight: One brood, mid-June into July

References: Royer 45, Opler & Krizek 241, Scott 449

Confirmed occurrences: Not encountered. Probably does occur in the area of Fort Union Trading Post in more favorable years.

Woodland Skipper

Ochlodes sylvanoides (Boisduval, 1852)

OCSY

Habitat: Shady, moist woodlands and chaparral; in mountains to 8,500 feet. An avid flower visitor, especially at late summer asters.

Larval food: Unknown, undoubtedly grasses.

Adult flight: One brood, mid-July through August

References: Royer 46, Ferris & Brown 106, Scott 450

Confirmed occurrences: Not encountered. Probably does not occur in the area of Fort Union Trading Post.

Hobomok Skipper

Poanes hobomok (Harris, 1862)

POHO

Habitat: Shady woodlands with moist soil, *Hesperis*, *Apocynum*

Larval food: Grasses, including *Panicum*, *Poa*

Adult flight: One brood, June

References: Royer 48, Opler & Krizek 244, Scott 453

Confirmed occurrences: One example encountered in woodland near river (SW of maintenance building, UTM 5316012n, 572106e) on 24 June 2004. Probably occurs regularly but is normally scarce throughout wooded portions of the Fort Union Trading Post area.

Dun Skipper

Euphyes vestris (Boisduval, 1852)

EURU

Habitat: Pastures, *Monarda* stands, lower areas in prairie

Larval food: Sedges, including various *Carex* spp., *Cyperus esculentus*

Adult flight: One brood, July

References: Royer 51, Opler & Krizek 252, Scott 456

Confirmed occurrences: Not encountered. Probably does occur in the area of Fort Union Trading Post in more favorable years.

Dusted Skipper

Atrytonopsis hianna (Scudder, 1868)

ATHI

Habitat: South-facing grassland slopes with *Schizachyrium*, bluestem prairies

Larval food: *Schizachyrium scoparius*

Adult flight: One brood, May into early June

References: Royer 52, Opler & Krizek 253, Scott 457

Confirmed occurrences: Not encountered. May occur in the upland prairie area north of Fort Union Trading Post in more favorable years.

Oslar's Roadside Skipper

Amblyscirtes oslari (Skinner, 1899)

AMOS

Habitat: Stream beds, dry hillsides and riparian watersheds in badlands

Larval food: *Bouteloua gracilis*

Adult flight: One brood, early June

References: Royer 53, Ferris & Brown 93, Scott 459

Confirmed occurrences: Not encountered. Probably does not occur in the area of Fort Union Trading Post.

Roadside Skipper

Amblyscirtes vialis (W. H. Edwards, 1862)

AMVI

Habitat: Woodland roadsides, glens; fond of *Apocynum* blooms

Larval food: Grasses, including *Poa*, *Avena*, *Agrostis*

Adult flight: One brood, May and early June

References: Royer 54, Opler & Krizek 258, Scott 463

Confirmed occurrences: Not encountered. Probably does occur in the area of Fort Union Trading Post in more favorable years.

Papilionidae The Swallowtails

Baird's Swallowtail

Papilio bairdii W. H. Edwards, 1866

PABA

Habitat: Badlands hilltops near *Artemisia dracunculus*

Larval food: *Artemisia dracunculus*

Adult flight: Two broods, May/June and July/August

References: Royer 60, Ferris & Brown 181, Scott 164

Confirmed occurrences: Not encountered. May occur in the prairie hilltops north of Fort Union Trading Post in more favorable years.

Anise Swallowtail

Papilio zelicaon Lucas, 1852

PAZE

Habitat: Western gardens, prairie hilltops near Apiaceae

Larval food: Wild Apiaceae, possibly including *Lomatium*, *Musineon*

Adult flight: One protracted brood, May into July

References: Royer 61, Ferris & Brown 183, Scott 170

Confirmed occurrences: Not encountered. Probably does not occur in the area of Fort Union Trading Post.

Canadian Tiger Swallowtail

Papilio (Pterourus) canadensis Rothschild & Jordan, 1906

PTCA

Habitat: Ash breaks, woodlands; often found on *Apocynum* blooms

Larval food: *Populus*, *Salix*, possibly also *Prunus*

Adult flight: One brood, early June

References: Royer 64, Opler & Krizek 49, Scott 179

Confirmed occurrences: Not encountered. Probably does not occur in the area of Fort Union Trading Post.

Two-tailed Swallowtail

Papilio (Pterourus) multicaudatus W. F. Kirby, 1884

PTMU

Habitat: Riparian ash breaks in badlands

Larval food: *Prunus*, *Fraxinus*

Adult flight: One brood, June and July

References: Royer 66 Ferris & Brown 189, Scott 182

Confirmed occurrences: Not encountered. May occasionally occur in the area of Fort Union Trading Post in more favorable years.

Pieridae The Whites and Sulphurs

Western White

Pontia occidentalis (Reakirt, 1866)

POOC

Habitat: Open prairie, especially on hilltops

Larval food: Cruciferae, including *Lepidium*, *Arabis*, *Sisymbrium*

Adult flight: Two broods, May and July

References: Royer 71, Ferris & Brown 150, Scott 222

Confirmed occurrences: Not encountered. May occur in the area of Fort Union Trading Post in more favorable years.

Cabbage Butterfly

Pieris rapae (Linnaeus, 1758)

ARRA

Habitat: Ubiquitous in gardens and roadsides in agricultural areas

Larval food: Cruciferae, occasionally also Capparidaceae

Adult flight: Multiple broods, May-September

References: Royer 73, Opler & Krizek 59, Scott 216

Confirmed occurrences: Not encountered. Probably does occasionally occur in the area of Fort Union Trading Post in more favorable years.

Olympia Marble

Euchloe olympia (W. H. Edwards, 1871)

EUOL

Habitat: Prairies and sage flats

Larval food: Cruciferae, including *Arabis*, possibly also *Sisymbrium*

Adult flight: One brood, flying predominantly in May

References: Royer 74, Opler & Krizek 62, Scott 215

Confirmed occurrences: Not encountered. May occur in the prairie area north of Fort Union Trading Post in more favorable years.

Clouded Sulphur

Colias philodice Godart, 1819

COPH

Habitat: Ubiquitous in agricultural areas

Larval food: Legumes, especially *Trifolium*, *Medicago* and *Melilotus*

Adult flight: Multiple broods, May-September

References: Royer 75, Opler & Krizek 64, Scott 198

Confirmed occurrences: Encountered both 24 June and 19 July 2004, when uncommon to fairly common throughout Fort Union Trading Post area.

Orange Sulphur or Alfalfa Butterfly

Colias eurytheme Boisduval, 1852

COEU

Habitat: Common in agricultural areas, though less so than *C. philodice*

Larval food: Legumes, especially *Medicago*, also *Melilotus*

Adult flight: Multiple broods, May-September

References: Royer 76, Opler & Krizek 65, Scott 196

Confirmed occurrences: Encountered on 24 June 2004. Only one example seen, but probably is present in most years and occasionally may be fairly common.

Queen Alexandra's Sulphur

Colias alexandra W. H. Edwards, 1863

COAL

Habitat: Badlands; rarely encountered in North Dakota

Larval food: Wild legumes, including *Astragalus*, *Hedysarum*, *Thermopsis*

Adult flight: Phenology unclear, June certainly, possibly also August

References: Royer 77, Ferris & Brown 161, Scott 195

Confirmed occurrences: Not encountered. Probably does not occur in the area of Fort Union Trading Post.

Lycaenidae The Gossamer Wings**Gray Copper**

Lycaena (Gaeides) dione (Scudder, 1868)

GAXA

Habitat: Prairie meadows, ditches, disturbed areas

Larval food: *Rumex obtusifolius*

Adult flight: One brood, late June through July

References: Royer 87, Opler & Krizek 83, Scott 391

Confirmed occurrences: Not encountered. May occur in the area of Fort Union Trading Post in more favorable years..

Bronze Copper

Lycaena (Hyllolycaena) hyllus (Cramer, 1775)

HYHY

Habitat: Open wet meadows with *Polygonum* or *Rumex*, pond margins, marshes, usually with neutral to alkaline soil pH

Larval food: *Rumex crispus*, *R. obiculatus*, *Polygonum* spp.

Adult flight: Two broods, June and August

References: Royer 88, Opler & Krizek 84, Scott 388

Confirmed occurrences: Not encountered. May occur in the area of Fort Union Trading Post in more favorable years..

Ruddy Copper

Lycaena (Chalceria) rubida (Behr, 1866)

CHRU

Habitat: Riparian wetlands and stream margins, that include *Rumex*

Larval food: *Rumex* spp.

Adult flight: One brood, late June

References: Royer 89, Ferris & Brown 230, Scott 391

Confirmed occurrences: Not encountered. Probably does not occur in the area of Fort Union Trading Post.

Purplish Copper

Lycaena (Epidemia) helloides (Boisduval, 1852)

EPHE

Habitat: Wastelands, wet ditches, open fields; a vagile species

Larval food: *Rumex* spp., *Polygonum* spp.

Adult flight: Two broods, June and August

References: Royer 90, Opler & Krizek 86, Scott 389

Confirmed occurrences: Not encountered. May occur in the area of Fort Union Trading Post in more favorable years, particularly near the river.

Coral Hairstreak

Satyrium (Harkenclenus) titus (Fabricius, 1793)

HATI

Habitat: Scrubby areas, especially with *Prunus*, *Crataegus* and *Asclepias*

Larval food: *Prunus* spp.

Adult flight: One brood, July, often flying into August

References: Royer 92, Opler & Krizek 89, Scott 360

Confirmed occurrences: Not encountered. May occur in the area of Fort Union Trading Post in more favorable years.

Striped Hairstreak

Satyrium liparops (Le Conte, 1833)

SALI

Habitat: Oak woodlands and wooded breaks or thickets that include *Amelanchier*, *Prunus*, *Crataegus*; especially fond of *Melilotus alba*, *Gypsophila* blooms

Larval food: Rosaceae, including *Prunus*, *Crataegus*, *Amelanchier*, etc.

Adult flight: One brood, late June, July

References: Royer 95, Opler & Krizek 94, Scott 362

Confirmed occurrences: Not encountered. Probably does not occur in the area of Fort Union Trading Post.

Sheridan's Hairstreak

Callophrys sheridanii (W. H. Edwards, 1877)

CASH

Habitat: Dry, brushy hillsides in badlands

Larval food: *Eriogonum* spp.

Adult flight: One brood, early May (ND's earliest emergent butterfly)

References: Royer 96, Ferris & Brown 259, Scott 378

Confirmed occurrences: Not encountered. Almost certainly does not occur in the area of Fort Union Trading Post.

Juniper Hairstreak

Mitoura siva (W. H. Edwards, 1874)

MISI

Habitat: Badlands around Junipers, fond of Butte Candle blooms

Larval food: *Juniperus scopulorum*

Adult flight: One brood, late May into June

References: Royer 97, Ferris & Brown 256, Scott 373 (under *M. gryneus*)

Confirmed occurrences: Not encountered. Probably does not occur in the area of Fort Union Trading Post.

Gray Hairstreak

Strymon melinus (Hübner, [1813])

STME

Habitat: Brushy, weedy, disturbed open areas; occasional

Larval food: Widely varied, including *Astragalus*, *Polygonum*, *Malva*

Adult flight: Two or three broods, May, July, September

References: Royer 100, Ferris & Brown 264, Scott 383

Confirmed occurrences: Not encountered. May be intermittent throughout the study area in any year.

Western Tailed Blue

Everes amyntula (Boisduval, 1852)

EVAM

Habitat: Humid, wooded areas with legumes, western ND

Larval food: Many legumes, including *Astragalus*, *Oxytropis*, *Trifolium*

Adult flight: Two broods, June and August (usually a smaller 2nd brood)

References: Royer 103, Ferris & Brown 219, Scott 396

Confirmed occurrences: Not encountered. May occasionally occur in the area of Fort Union Trading Post in more favorable years.

Spring Azure

Celastrina ladon (Cramer, 1780)

CEAR

Habitat: Most often associated with *Amelanchier* blooms in spring

Larval food: *Prunus* in west; *Cornus*, *Viburnum*, etc., in north and east. We probably have two species in North Dakota, best differentiated by their larval hosts.

Adult flight: The western taxon is univoltine, flying only in May while *Amelanchier* and *Ribes* are in bloom.

References: Royer 104, Ferris & Brown 221, Opler & Krizek 116, Scott 396

Confirmed occurrences: Not encountered. May occur in the area of Fort Union Trading Post in more favorable years.

Silvery Blue

Glaucopsyche lygdamus (Doubleday, 1841)

GLLY

Habitat: Open areas in or near woodlands

Larval food: Legumes, including *Lupinus*, *Astragalus*, *Hedysarum*

Adult flight: Widespread, late May through June, one brood only

References: Royer 105, Opler & Krizek 119, Scott 399

Confirmed occurrences: Not encountered. Probably does occur in the area of Fort Union Trading Post in more favorable years.

Melissa Blue

Lycaeides melissa (W. H. Edwards, 1873)

LYME

Habitat: Open prairies

Larval food: Legumes, including *Lupinus*, *Astragalus*, *Oxytropis*, *Glycyrrhiza*

Adult flight: Two broods, June and August

References: Royer 106, Ferris & Brown 202, Scott 407

Confirmed occurrences: Encountered on 19 July, but uncommon. Probably does appear more commonly in the area of Fort Union Trading Post in more favorable years.

Greenish Blue

Plebejus saepiolus (Boisduval, 1852)

PLSA

Habitat: Wooded clearings

Larval food: *Trifolium* spp. exclusively

Adult flight: One protracted brood, mid-June through July

References: Royer 107, Ferris & Brown 204, Scott 408

Confirmed occurrences: Not encountered. Probably does not occur in the area of Fort Union Trading Post.

Acmon Blue

Icaricia acmon (Westwood, [1851])

ICAC

Habitat: *Eriogonum* flats along upper slopes in badlands, where it patrols and takes nectar at its presumed larval host, *Eriogonum*

Larval food: *Eriogonum* spp., also possibly *Astragalus*, *Lupinus*

Adult flight: Two broods, June and August, the second being synchronous and sympatric with flight of *Apodemia mormo*

References: Royer 110, Ferris & Brown 206, Scott 411

Confirmed occurrences: One example encountered near Bodmer Overlook (out of Fort Union land, UTM 5317827n, 572550e); apparently breeding in barren prairie slopes north of Fort Union.

Riodinidae The Metalmarks**Mormon Metalmark**

Apodemia mormo (Felder & Felder, 1859)

APMO

Habitat: *Eriogonum* ledges and steep slopes in badlands, where it perches and takes nectar at blooms of *Chrysothamnus* and especially of its larval host, *Eriogonum*.

Larval food: *Eriogonum* spp.

Adult flight: One brood, August; synchronous and sympatric with second brood of *Icaricia acmon* and with *Cercyonis meadii*.

References: Royer 113, Ferris & Brown 197, Scott 348

Confirmed occurrences: Not encountered. Probably does not occur in the area of Fort Union Trading Post.

Nymphalidae The Brush-footed Butterflies

Subfamily **Heliconiinae** Heliconians and Fritillaries

Variegated Fritillary

Euptoieta claudia (Cramer, 1775)

EUCL

Habitat: Southern migrant, often common in open prairies

Larval food: A wide range of seemingly unrelated plant spp., including *Viola*, *Portulaca*, *Desmodium*, *Menispermum*

Adult flight: Continuous breeder arriving in May, often abundant by fall

References: Royer 119, Opler & Krizek 130, Scott 335

Confirmed occurrences: Encountered both 24 June and 19 July 2004, in each case in the form of only one example. Probably fairly common in favorable years.

Great Spangled Fritillary

Speyeria cybele (Fabricius, 1775)

SPCY

Habitat: Woodland margins, often nectaring *Cirsium*, *Monarda*, or *Liatris*

Larval food: *Viola* spp. (larva overwinters shortly after eclosure)

Adult flight: Late June into early August

References: Royer 120, Opler & Krizek 132, Scott 325

Confirmed occurrences: Not encountered, but probably does occur in wooded areas around Fort Union Trading Post in more favorable years.

Aphrodite Fritillary

Speyeria aphrodite (Fabricius, 1787)

SPAP

Habitat: Open meadows, nectars at *Cirsium*, *Monarda*, *Liatris*; males patrol continuously when not taking nectar or resting

Larval food: *Viola* spp. (larva overwinters shortly after eclosure)

Adult flight: Late June into early August, depending on location

References: Royer 121, Opler & Krizek 133, Scott 324

Confirmed occurrences: Encountered 19 July 2004, but only one example. Probably does occur fairly regularly in prairie areas in favorable years.

Edwards' Fritillary

Speyeria edwardsii (Reakirt, 1866)

SPED

Habitat: Native prairies in southwestern North Dakota; nectars avidly at *Cirsium*

Larval food: *Viola* spp. (larva overwinters in 1st stage)

Adult flight: Mid-June into July (earlier than other *Speyeria* spp.)

References: Royer 123, Ferris & Brown 304, Scott 335

Confirmed occurrences: Not encountered. May occur in the prairie areas around Fort Union Trading Post in more favorable years.

Callippe Fritillary

Speyeria callippe (Boisduval, 1852)

SPCA

Habitat: Native prairies; nectars avidly at *Medicago*, *Cirsium*

Larval food: *Viola* spp. (larva overwinters in 1st stage)

Adult flight: Mid-June into July (earlier than most *Speyeria* spp.)

References: Royer 124, Ferris & Brown 307, Scott 329

Confirmed occurrences: Not encountered. Probably does occur in the prairie areas near Fort Union Trading Post in more favorable years.

Subfamily **Nymphalinae** Crescents, Checkerspot, and Anglewings

Gorgone Checkerspot

Charidryas gorgone (Hübner, [1810])

CHGO

Habitat: Dry prairies, disturbed fields, roadsides; favors mud puddles

Larval food: *Helianthus* spp. (larva overwinters in 3rd stage)

Adult flight: Two broods, June and August

References: Royer 130, Opler & Krizek 140, Scott 303

Confirmed occurrences: Not encountered. Probably does occur regularly in prairie areas in favorable years.

Acastus Checkerspot

Charidryas acastus (W. H. Edwards, 1874)

CHAC

Habitat: Riparian canyons, meadows, mudslides in badlands

Larval food: Asteraceae, including *Aster*, *Helianthus*, *Actinomeris*, etc.

Adult flight: Two broods, May-June and July-August

References: Royer 133, Ferris & Brown 325, Scott 306 (under *gabbii*)

Confirmed occurrences: Not encountered. May occur in adjacent badlands areas in favorable years.

Pearl Crescent

Phyciodes tharos (Drury, 1773)

PTHH

Habitat: Sunny places, roadsides, widespread

Larval food: *Aster* spp.

Adult flight: Multiple broods; May, June-July, August-September

References: Royer 135, Opler & Krizek 145, Scott 311

Confirmed occurrences: Not encountered. Probably does occur regularly in open areas in favorable years.

Comma or Hop Merchant

Polygonia comma (Harris, 1842)

POCO

Habitat: Shady woodlands, sunlit patches late afternoon; adults drink running sap and juices of rotting fruit

Larval food: *Urtica* spp., possibly also *Ulmus*

Adult flight: Overwinters as adult, appearing April-May to produce a dark-winged summer form by late June. These in turn produce a second, light-winged, overwintering brood in August.

References: Royer 139, Opler & Krizek 151, Scott 284

Confirmed occurrences: Not encountered. May occur occasionally in woodland areas in favorable years.

Gray Comma

Polygonia progne (Cramer, 1775)

POPG

Habitat: Deciduous woodlands, sunlit patches late afternoon; adults drink running sap and juices of rotting fruit

Larval food: *Ribes* spp.

Adult flight: Overwinters as adult, appearing April-May to produce a dark-winged summer form by late June. These in turn produce a second, light-winged, overwintering brood in August.

References: Royer 143, Opler & Krizek 154, Scott 287

Confirmed occurrences: Not encountered. May occur occasionally in woodland areas in favorable years.

Compton Tortoise Shell

Nymphalis vaualbum ([Denis & Schiffermüller], 1775)

NYVA

Habitat: Mature forests; adults drink sap and rotting fruit juices

Larval food: *Populus*, *Betula*, *Salix* spp.

Adult flight: Overwinters as adult, appearing April-May to produce a single annual brood by early July.

The species is episodic and somewhat migratory, being rare for several years, then suddenly common.

References: Royer 144, Opler & Krizek 155, Scott 290

Confirmed occurrences: Not encountered. May occur occasionally in woodland areas in favorable years.

Mourning Cloak

Nymphalis antiopa (Linnaeus, 1758)

NYAN

Habitat: Riparian forests; adults drink *Quercus* sap and fermenting fruit juices, and occasionally the nectar of such flowers as *Asclepias*, *Apocynum*, etc.

Larval food: *Salix* spp. primarily, but also *Populus*, *Betula*, *Ulmus*

Adult flight: Overwinters as adult, appearing April-May to produce a single annual brood by early July.

Partially southward migratory; adults live nearly a year

References: Royer 146, Opler & Krizek 156, Scott 291

Confirmed occurrences: Not encountered. Probably occurs in woodland areas in favorable years.

Milbert's Tortoise Shell

Aglais milberti (Godart, 1819)

AGMI

Habitat: Widespread across the state in autumn

Larval food: *Urtica* and *Salix* spp. also possibly *Helianthus*

Adult flight: Confused; one to four broods reported; probably two in ND

References: Royer 147, Opler & Krizek 157, Scott 289

Confirmed occurrences: Not encountered. Probably occurs occasionally in woodland areas in favorable years.

American Painted Lady

Vanessa virginiensis (Drury, 1773)

VAVI

Habitat: Open prairies and meadows

Larval food: *Antennaria*; probably other everlasting

Adult flight: Sporadic spring immigrant, mostly to southern counties; does not survive winter

References: Royer 148, Opler & Krizek 158, Scott 283

Confirmed occurrences: Not encountered. May occur occasionally in open areas in favorable years.

Painted Lady

Vanessa cardui (Linnaeus, 1758)

VACA

Habitat: Open prairies, roadsides and meadows

Larval food: *Cirsium* primarily; also *Helianthus*, many other composites

Adult flight: Frequent spring immigrant; does not survive winter

References: Royer 149, Opler & Krizek 159, Scott 289

Confirmed occurrences: Not encountered. Probably occurs regularly in open areas during favorable years.

Red Admiral

Vanessa atalanta (Linnaeus, 1758)

VAAT

Habitat: Sunlit patches in woodland clearings near nettles

Larval food: *Urtica*

Adult flight: Regular spring immigrant; does not survive winter

References: Royer 151, Opler & Krizek 160, Scott 280

Confirmed occurrences: Not encountered. Almost certainly occurs in woodland areas in favorable years.

Subfamily **Limenitidinae** Admirals

Viceroy

Basilarchia archippus (Cramer, 1775)

BAAR

Habitat: In wet-mesic situations, often around wet meadows with willows

Larval food: *Salix*, possibly sometimes *Populus*

Adult flight: Double-brooded, appearing in early June and early August

References: Royer 156, Opler & Krizek 167, Scott 259

Confirmed occurrences: Not encountered. Probably occurs occasionally in willow areas in favorable years.

Weidemeyer's Admiral

Basilarchia weidemeyerii (W. H. Edwards, 1861)

BAWE

Habitat: Woodland breaks in badlands

Larval food: *Populus*, *Salix*, *Prunus*

Adult flight: One brood, appearing in late June through July

References: Royer 157, Ferris & Brown 350, Scott 262

Confirmed occurrences: Not encountered. Probably does not occur in Fort Union Trading Post area.

Subfamily **Satyrinae** Satyrs and Wood Nymphs

Inornate Ringlet

Coenonympha inornata W. H. Edwards, 1861

COIN

Habitat: Open, grassy meadows and native prairies

Larval food: Doubtless many grass species are utilized

Adult flight: One brood, primarily in late May and June

References: Royer 165, Opler & Krizek 186, Scott 239 (as *tullia*)

Confirmed occurrences: Encountered on 24 June 2004, but uncommon. Undoubtedly occurs regularly in prairie areas in favorable years.

Common Wood Nymph

Cercyonis pegala (Fabricius, 1775)

CEPE

Habitat: Native prairies and grasslands

Larval food: *Andropogon*, *Stipa*; many grasses are no doubt utilized

Adult flight: One brood, primarily in July and August

References: Royer 166, Opler & Krizek 186, Scott 240

Confirmed occurrences: Encountered on 19 July 2004, but uncommon. Undoubtedly occurs regularly in prairie areas in favorable years.

Mead's Wood Nymph

Cercyonis meadii (W. H. Edwards, 1872)

CEME

Habitat: Badlands canyons, often found with 2nd brood *Icaricia acmon* at the blooms of *Eriogonum* on eroded badlands slopes

Larval food: Unknown, probably *Bouteloua gracilis*

Adult flight: One brood, primarily in August

References: Royer 167, Ferris & Brown 274, Scott 242

Confirmed occurrences: Not encountered. Probably does not occur in Fort Union Trading Post area.

Dark Wood Nymph

Cercyonis oetus (Boisduval, 1869)

CEOE

Habitat: Open woodlands and sage flats in badlands

Larval food: Unknown grass sp.

Adult flight: One brood, July into August

References: Royer 168, Ferris & Brown 275, Scott 242

Confirmed occurrences: Not encountered. Probably does not occur in Fort Union Trading Post area.

Varuna Arctic

Oeneis uhleri varuna (W. H. Edwards, 1882)

OEUH

Habitat: TL = "Plains of Dakota Territory"; well drained prairie slopes

Larval food: Unknown grass sp.

Adult flight: One brood, mid-May into June

References: Royer 171, Ferris & Brown 284, Scott 250

Confirmed occurrences: Not encountered. Probably does occur occasionally within native prairie in Fort Union Trading Post area.

Subfamily **Danainae** The Milkweed Butterflies

Monarch

Danaus plexippus (Linnaeus, 1758)

DAPL

Habitat: Widespread immigrant

Larval food: *Asclepias* spp.

Adult flight: Sparse northward immigration in spring results in multiple broods; southward fall migrations can be quite spectacular

References: Royer 174, Opler & Krizek 193, Scott 229

Confirmed occurrences: Not encountered. Probably does occur in Fort Union Trading Post area in favorable years.

Section III – Recommendations to Park Management

General background -- The 2004 butterfly season in North Dakota was unusual in several ways. Spring emergences began approximately one week earlier than usual, with normal to above-normal butterfly numbers throughout April and May. In early June, at the beginning of the flight of many important species, several untimely freezes brought all butterfly emergences to an abrupt halt statewide. By early July, emergence for most species was either not apparent or as much as two weeks later than normal. Consequently, hesperine skippers, including many species that should occur in the Ft. Union area, were uncommon to rare throughout western North Dakota. Absence of many species from survey encounter lists therefore may not mean that they do not normally occur in the study site in more normal years. Occurrence comments in the above material are written with this in mind and reflect this reality.

Since butterflies are essentially place-bound in all but the adult stage, endemism is an important factor to consider in prairie butterfly conservation and management. Life histories of endemic prairie butterflies typically are closely bound to very specific ecological conditions. Even adults may be intimately tied to

specialized habitat demands within a given parcel. Modern management treatments must therefore be applied on a scale small enough to correspond to the scope in which the butterflies themselves operate (Kirby 1992). In many portions of the Fort Union Trading Post area, this might be only a few square meters within a given habitat. For these reasons butterflies respond quite differently to wide-scale management activities than do either plants or the larger, more motile, vertebrate taxa.

Taken together, these factors offer some indication of how easily a population may be extirpated when wide-scale management events such as controlled burning, insect control efforts, or overgrazing occur in isolated prairie remnants where repopulation from outside is unlikely. Many of the more sensitive species endemic or potentially linked to the study area may be said to fall into this category.

Survey of Fort Union butterfly niches -- To help managers deal with this habitat specialization, Swengel (1996) has organized prairie butterflies into four groups related to niche breadth as follows:

- a) *specialists* -- prairie obligates with unique habitats
- b) *grassland* species -- those unique to grasslands but more widespread in occurrence
- c) *generalists* -- those which also occur in habitats outside the grassland environment, and
- d) *invaders* -- widespread and vagile species most likely to repopulate disturbed situations where other butterflies have been eliminated.

Some general management observations in this context – Butterfly diversity and abundance offer clear indication of the health of the prairie environment. Any management that would diminish either butterfly diversity or butterfly abundance should be avoided. At Fort Union, the primary disturbances are three:

- 1) There is a history of over-grazing in the area of the Bodmer Overlook. (Evidence of this takes the form of dry, compact soils, severe deterioration of native floral diversity throughout NPS acreage there, and an almost complete absence of butterflies throughout the period of field work.)
- 2) Management of the prairie immediately surrounding the fort is designed to produce a “monocot monoculture” that in the long run will be unable to support breeding populations of most native prairie *specialist* butterflies in the region because of the dearth of broadleaf flora.

- 3) Intermittent natural flooding of nearly all of the woodland habitat within NPS jurisdiction precludes any reasonable effort to establish or conserve populations of *invader* butterfly species that may be found there from time to time.

Given three facts, namely (a) that there is currently no habitat suitable for prairie *specialist* butterflies (which require native forbs as well as native grasses), (b) that there is little stable woodland habitat that would support reliable reproduction of native sciophilic butterfly species, and (c) that there was very little nectar available throughout the study area during most of the survey period, the logical conclusion is that something is ecologically amiss within Fort Union Trading Post NHS when it comes to butterfly habitat. Indeed, the dramatic difference in diversity and abundance levels between butterfly populations there and in many equivalent nearby environments, even in an otherwise bad butterfly year, suggests that a comprehensive butterfly (ideally an invertebrate) management plan is sorely needed for Fort Union Trading Post in order to establish a biota similar to that at the time the fort was established.

Recommendations for Continued Monitoring – Such a plan will first of all require consistent monitoring. The hypothetical list of potential species given in Table 1 was compiled from formal records for the immediate area. While some of the hypothetically resident species were encountered during the survey, many were simply absent, and none were seen in numbers that would indicate healthy populations. Many other potential breeding residents or assumed regular immigrants are also included in the list, since it is deemed likely that if there were proper habitat they might be confirmed at some time in the future, particularly in years more favorable than 2004. Monitoring would document any recovery or further losses.

For continued monitoring, and because it is nearly impossible to establish abundance for any resident species in a single season over an extensive prairie area, it is recommended that Fort Union Trading Post be surveyed regularly throughout at least one full day during each of three periods of a given survey year: 1) the first three weeks of June, 2) late June through the first half of July, and 3) throughout August and early September for overwintering species. For consistency with other North Dakota butterfly survey efforts, the following basic protocols are recommended whenever one surveys any part of Fort Union Trading Post:

- *The sampling day should extend from approximately 9 am until not later than 5 pm.*

- *Butterflies should be recorded with encoded four-letter acronyms (see individual species listings) used by the author of this report in statewide database management.*
- *A walking pace should be steady and regular at approximately 35 meters per minute.*
- *Only butterflies actually seen within an estimated 2.5 meters on either side of the surveyor, within 5.0 meters of the ground, and 5.0 meters to the front should be counted.*

Vouchers Collected and Repository

Very few specimens were collected during the course of this inventory. Those that were are all on deposit in the collection at the park.

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Part Two:
**Inventory of Butterflies at Knife River Indian Villages National Historic Site in
2004**

Section I – Introduction and Methods

General Introduction -- Field work consisted of strategically timed field visits from June through August 2004. Each survey stop within this context was chosen specifically to target situations representing "probable best habitat" in the area. The method used for determining "probable best habitat" was based on the author's experience with the various species expected from the site (once on site the target species were actively "hunted").

This report is written in three sections, *Introduction and Methods*, *Results and Discussion*, and *Recommendations to Park Management*. Section II is principally an annotated list of species encountered or otherwise documented for the site. It addresses the primary objective of providing a definitive inventory for the park unit. This information leads to the conservation observations of Section III, as they derive naturally from analysis of known ecological needs of the encountered species.

For some butterfly species, collection and preparation of voucher specimens was undertaken in order (a) to confirm occurrence formally for the record or (b) to ensure that an identification can be confirmed in the future. Voucher and repository information is given within individual accounts in the annotated list, which addresses all butterfly species, whether they were actually encountered or, although not encountered in 2004, may reasonably be expected to reproduce in the study area during a normal year.

Area Covered by this Study -- The scope of this document includes only habitats within the designated study area - approximately 1758 acres within Knife River Indian Villages National Historic Site in Mercer County, North Dakota. For possible later geographical information system (GIS) use, all rare or unusual species encounters were recorded by UTM coordinate (NAD27), when either a specimen was vouchered or there was an observation of one or more examples. This information is provided conveniently in a table within the narrative that follows.

Sampling Methodology -- Work was begun in late May, with a preliminary survey of the area to determine location and usefulness of access roads. This provided a practical picture of the logistical scope of the task.

Table 3 offers a preliminary hypothetical list of species believed at the beginning of the study might be expected at Knife River Indian Villages National Historic Site. As noted above, the survey was structured around actually "hunting" for species on this list. The method employed was focused "checklist" searching, as defined in Royer, Austin, and Newton (1998). Timing of visits was defined by habitat and phenology information in Royer (2003) as adjusted on the basis of knowledge of the 2004 butterfly season.

Table 3. A preliminary hypothetical list of butterfly species that might reasonably be expected (on biogeographical grounds and habitat analysis) to occur at Knife River Indian Villages NHS.

Family/Species	Source of expectation for potential breeding status
Hesperiidae	
<i>Epargyreus clarus</i>	Park collection; Kendall report (1993)
<i>Thorybes pylades</i>	Park collection; Kendall report (1993)*
<i>Pyrgus communis</i>	Park collection; Kendall report (1993)*
<i>Pholisora catullus</i>	On record in adjacent counties, probable occasionally in sunny areas
<i>Ancyloxypha numitor</i>	On record in adjacent counties, possible for wetlands or river margins
<i>Oarisma garita</i>	Park collection*
<i>Hesperia uncas</i>	On record in adjacent counties, possible for prairie section on North Forest Trail
<i>Hesperia comma assiniboia</i>	On record for Mercer County, probable for prairie section on North Forest Trail
<i>Hesperia ottoe</i>	On record in adjacent counties, possible for prairie section on North Forest Trail
<i>Hesperia leonardus pawnee</i>	On record in adjacent counties, possible for prairie section on North Forest Trail
<i>Polites peckius</i>	On record in adjacent counties, possible for more mesic open areas near prairie
<i>Polites themistocles</i>	Kendall report (1993)*
<i>Poliotes origenes</i>	On record in adjacent counties, possible for prairie section on North Forest Trail
<i>Poliotes mystic</i>	On record in adjacent counties, probable throughout park
<i>Anatrytone logan</i>	On record in adjacent counties, possible for prairie section on North Forest Trail
<i>Poanes hobomok</i>	On record in adjacent counties, probable for woodland sections of North Forest Trail
<i>Euphyes vestris</i>	On record in adjacent counties, probable throughout park
<i>Amblyscirtes vialis</i>	On record in adjacent counties, possible in wooded sections
Papilionidae	
<i>Papilio bairdii</i>	On record in Mercer County, possible for prairie section on North Forest Trail
<i>Papilio zelicaon</i>	On record in Mercer County, possible for prairie section on North Forest Trail
<i>Papilio canadensis</i>	Park collection; in Kendall report (1993)* as <i>P. glaucus</i>
Pieridae	
<i>Pontia occidentalis</i>	On record in adjacent counties, possible for prairie section on North Forest Trail
<i>Pieris rapae</i>	On record for Mercer County; park collection; in Kendall report (1993)
<i>Colias philodice</i>	Park collection; Kendall report (1993); observed on 27 May preliminary visit
<i>Colias eurytheme</i>	On record in Mercer County; in Kendall report (1993)
Lycaenidae	
<i>Lycaena dione</i>	On record in adjacent counties, possible for wetlands or river margins

<i>Lycaena hyllus</i>	On record in adjacent counties, possible for wetlands or river margins
<i>Lycaena helloides</i>	On record in adjacent counties, possible for wetlands or river margins
<i>Satyrrium acidicum</i>	On record in adjacent counties; possible for willow areas that bear <i>Asclepias</i> spp.
<i>Satyrrium titus</i>	On record in adjacent counties; possible for areas with <i>Prunus</i> , <i>Asclepias</i>
<i>Satyrrium liparops</i>	On record in adjacent counties; possible for wooded areas with Rosaceae
<i>Strymon melinus</i>	On record in adjacent counties; possibly occasional throughout park
<i>Celastrina ladon</i>	Park collection; Kendall report (1993)*
<i>Glaucopteryx lygdamus</i>	Park collection; Kendall report (1993)*
<i>Lycaeides melissa</i>	On record in adjacent counties; observed on 27 May preliminary visit*

Nymphalidae

<i>Euptoieta claudia</i>	Kendall report (1993)*
<i>Speyeria cybele</i>	Park collection; Kendall report (1993)*
<i>Speyeria aphrodite</i>	Park collection; Kendall report (1993)*
<i>Speyeria callippe</i>	On record in adjacent counties, possible, especially in prairie section on North Forest
Trail	
<i>Charidryas gorgone</i>	On record in adjacent counties; possible in open portions of site
<i>Phyciodes tharos</i>	Park collection; Kendall report (1993); observed on 27 May preliminary visit
<i>Polygonia comma</i>	On record in adjacent counties; possible for wooded areas
<i>Polygonia progne</i>	On record in adjacent counties; possible for wooded areas
<i>Nymphalis antiopa</i>	Park collection; Kendall report (1993)*; observed on 27 May preliminary visit
<i>Aglais milberti</i>	Kendall report (1993)
<i>Vanessa cardui</i>	Kendall report (1993)*
<i>Vanessa atalanta</i>	Kendall report (1993)*
<i>Limenitis arthemis</i>	On record in Mercer County; probable around woodlands
<i>Limenitis archippus</i>	On record in Mercer County; possible near willows
<i>Enodia anthedon</i>	On record in Mercer County; probable in North Forest Trail woodlands
<i>Satyrodes eurydice</i>	Park collection; Kendall report (1993)*
<i>Megisto cymela</i>	Kendall report (1993)*
<i>Coenonympha inornata</i>	On record in Mercer County; park collection; Kendall report (1993)
<i>Cercyonis pegala</i>	On record in Mercer County; park collection; Kendall report (1993)
<i>Oeneis uhleri varuna</i>	On record in Mercer County; Kendall report (1993); observed on 27 May preliminary visit
<i>Danaus plexippus</i>	Park collection; probable throughout park

* Not yet formally reported in published literature; represents new county record

Section II – Results and Discussion

Summary of Noteworthy Encounters -- Table 4 itemizes noteworthy species encounters in summary

form. Details on all encounters are given within the separate species listing below. An inexpensive hand-held *Magellan 315* gps unit provided sufficient precision for marking encounter location of the occasional noteworthy species

Table 4. Summary of findings (including UTM coordinates for particularly significant encounters) at Knife River. Abundance codes are as follows: R = rare; O = occasional; UC = uncommon; FC = fairly common; C = common; VC = very common; A = abundant. They are based on frequency of encounter per survey hour.

Family/Species	Encounter Date	UTM (n)	UTM (e)	Abundance
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Hesperiidae

<i>Epargyreus clarus</i>	28 June, 13 July	--	--	R, R
<i>Pyrgus communis</i>	28 Aug	--	--	UC
<i>Pholisora catullus</i>	16 June	5247790	14_319923	R
<i>Oarisma garita</i>	16 June, 13 July	--	--	UC, R
<i>Hesperia comma assiniboia</i>	28 August	5249457	14_319606	R
<i>Hesperia leonardus pawnee</i>	28 August	5249441	14_319571	FC
<i>Poliotes origenes</i>	13 July	5249365	14_319693	R
<i>Poliotes mystic</i>	28 June, 13 July	--	--	UC, R
<i>Anatrytone logan</i>	13 July, 30 July	5249394	14_319626	R, R
<i>Poanes hobomok</i>	16 June, 28 June, 13 July	--	--	--

C, R, R

Papilionidae

<i>Papilio canadensis</i>	28 June	--	--	R
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Pieridae

<i>Pieris rapae</i>	16 June, 28 June, 13 July, 30 July, 28 Aug			FC, FC, VC, A, A
<i>Colias philodice</i>	27 May, 16 June, 13 July, 30 July, 28 Aug			A, A, VC, VC, FC
<i>Colias eurytheme</i>	16 June, 28 June, 13 July, 30 July, 28 Aug			R, R, R, FC, FC

Lycaenidae

<i>Lycaena dione</i>	13 July	--	--	UC
<i>Satyrrium titus</i>	30 July, 28 Aug	--	--	C, UC
<i>Glaucopsyche lygdamus</i>	27 May, 16 June	--	--	R, UC
<i>Lycaeides melissa</i>	27 May, 16 June, 28 June, 13 July, 30 July, 28 Aug			UC, FC, FC, R, UC, FC

Nymphalidae

<i>Euptoieta claudia</i>	30 July	--	--	UC
<i>Speyeria cybele</i>	13 July, 30 July, 28 Aug	--	--	FC, VC, UC
<i>Speyeria aphrodite</i>	30 July, 28 Aug	--	--	FC, UC
<i>Speyeria callippe</i>	28 June	--	--	R
<i>Speyeria idalia</i>	30 July	5249571	14_319476	UC
<i>Phyciodes tharos</i>	27 May, 28 June, 30 July	--	--	R, R, UC
<i>Polygonia comma</i>	13 July, 30 July	--	--	C, FC
<i>Nymphalis antiopa</i>	27 May, 16 June, 28 June, 13 July	--	--	UC, R, R
<i>Aglais milberti</i>	13 July	--	--	R
<i>Vanessa cardui</i>	16 June, 28 June, 28 Aug	--	--	--
<i>Vanessa atalanta</i>	27 May, 16 June, 28 June, 13 July, 30 July			FC, A, C, UC, R
<i>Limenitis arthemis</i>	13 July, 30 July	--	--	R, R
<i>Enodia anthedon</i>	13 July, 30 July	5248375	14_319948	R (also 5243923n, 320495e),
FC <i>Satyrodes eurydice</i>	13 July	5247000	14_320187	R
<i>Coenonympha inornata</i>	16 June, 28 June	--	--	VC, UC
<i>Cercyonis pegala</i>	13 July, 30 July, 28 Aug	--	--	C, A, FC
<i>Oeneis uhleri varuna</i>	27 May	--	--	UC
<i>Danaus plexippus</i>	16 June, 28 June, 13 July, 30 July, 28 Aug			R, UC, UC, C, R

FC, R

Format of the Individual Listing -- In the separate listings which follow, a species is first identified on

the left by its common name, after which is given its Latin name (at the binomial level unless the trinomial

is pertinent), including its original author (if parenthesized, under a different genus name) and the date of original description. Under the Latin name is given the species' four-letter North Dakota Code (NDC) statewide database recording code. The NDC system consists of four-letter reporting/database codes originally derived from binomial names in Miller & Brown (1981), as amended by Ferris (1989). For example, *Enodia anthedon* = ENAN. These codes have been employed for several years in long-term butterfly monitoring projects at a number of North Dakota sites, and for the sake of congruency with existing database material they are the preferred codes for reporting butterfly survey data in the state. The sequence of listings follows the phylogenetic arrangement used by the above authors.

After the material on naming there is a brief description of typical habitat, in some cases of adult food sources, etc. This information is followed by an indication of the principal larval host(s), where these are specifically known, and that by information on adult phenology. Abundance is noted as follows:

"Abundant" means encounter with more than 10 individuals may be expected per hour of survey time.

"Common" means more than five individuals. "Uncommon" means fewer than five but typically at least one. "Occasional" means some counts may include encounter and others not. "Rare" means regular encounter is not to be expected.

Confirmations of occurrence in the study area are based as follows: Collection of voucher specimens, observation during field visits, presumption of regular occurrence (generally on the basis of known ubiquitous local distribution), historical record, assumed likelihood of eventual discovery. For any noteworthy encounters, the location was recorded by UTM coordinates, and tables and species accounts below include that information for all encounters.

All this material is followed by abbreviated citations for published works in which more detailed information may be located. The abbreviation includes the last names of authors and the page numbers on which the main textual entries will be found. These reference works are as follows:

- Royer, Ronald Alan. 2003. *Butterflies of North Dakota: An Atlas and Guide*. Minot State University Science Monograph Number Two. (Specifically for North Dakota)
- Ferris, Clifford D. and Brown, F. Martin. 1981. *Butterflies of the Rocky Mountain States*. University of Oklahoma Press. Norman. (For principally western taxa)
- Layberry, Ross A., Hall, Peter W., and Lafontaine, J. Donald. 1998. *The Butterflies of Canada*. University of Toronto Press. Toronto. (For principally northern taxa)

- Opler, Paul A. and Krizek, George O. 1984. *Butterflies East of the Great Plains: An Illustrated Natural History*. The Johns Hopkins University Press. Baltimore.
(For principally eastern taxa)
- Scott, James A. 1986. *Butterflies of North America: A Natural History and Field Guide*. Stanford University Press. Stanford, California. (For taxa of all regions)

In addition to these resources, one may also wish to consult the Northern Prairie Wildlife Research Center on-line resources titled "Atlas of North Dakota Butterflies" and "Butterflies of North America" at <http://www.npwrc.org>.

Finally, the listing of references is followed by a record of encounters made during the 2004 butterfly survey season and/or any historic records pertinent to the study area or nearby adjacent habitats. All records designated as "vouchered," "encountered," or "observed" refer to the above-described field surveys. What follows is an annotated list of species now known from or presumably to be discovered within Knife River Indian Villages NHS. Occurrence information occasionally includes comments on a species' ecological importance.

Hesperiidae The Skippers

Silver-Spotted Skipper

Epargyreus clarus (Cramer, 1775)

EPCL

Habitat: Sunlit wooded clearings; *Apocynum* blooms

Larval food: Wild licorice (*Glycyrrhiza lepidota*)

Adult flight: One brood in June and early July

References: Royer 14, Opler & Krizek 199, Scott 470

Confirmed occurrences: Encountered 28 June and 13 July 2004, a single individual in both instances.

Probably fairly common around woodlands, particularly near Sakakawea Park in the far southern part of the site.

Northern Cloudy Wing

Thorybes pylades (Scudder, 1870)

THPY

Habitat: Widespread in forested areas, often at *Eleagnus*, *Apocynum* blooms

Larval food: Legumes

Adult flight: Late May, June

References: Royer 15, Opler & Krizek 204, Scott 479

Confirmed occurrences: Not encountered, but probably occurs in or near Knife River Indian Villages NHS in favorable years.

Common Checkered Skipper

Pyrgus communis (Grote, 1872)

PYCO

Habitat: Open, dry, sunny ground

Larval food: Malvaceae

Adult flight: Spring immigrants yield at least one additional brood

References: Royer 22, Ferris & Brown 83, Scott 495

Confirmed occurrences: Encountered 28 August in north prairie area. Probably occasional in sunny areas throughout the study area in most years.

Common Sooty Wing

Pholisora catullus (Fabricius, 1793)

PHCA

Habitat: Open spaces, bare soil, mud puddles, roadbeds

Larval food: Goosefoots and Amaranths

Adult flight: May-June and July-August

References: Royer 23, Opler & Krizek 218, Scott 498

Confirmed occurrences: One example observed on 16 June at 5247790n, 319923e (North Forest Trail).

May be encountered in sunny areas in the study area in intermittent years.

Least Skipper

Ancyloxypha numitor (Fabricius, 1793)

ANNU

Habitat: Stream margins, swamps and wetlands

Larval food: Aquatic grasses

Adult flight: May-June and July-August

References: Royer 27, Opler & Krizek 222, Scott 431

Confirmed occurrences: Not observed during study, but may occur in wetlands associated with Knife River.

Garita Skipperling

Oarisma garita (Reakirt, 1866)

OAGA

Habitat: Open mixed-grass prairie; likes legume and composite flowers

Larval food: Native prairie grasses, including *Stipa*, *Poa*, *Bouteloua*

Adult flight: One brood, Late May throughout June; approximately two weeks later during 2002

References: Royer 29, Ferris & Brown 137, Scott 431

Confirmed occurrences: Encountered on 16 June and 13 July in north prairie area.

Uncas Skipper

Hesperia uncas (W. H. Edwards, 1878)

HEUN

Habitat: Native mid-grass to short-grass prairie hilltops

Larval food: *Bouteloua gracilis*

Adult flight: Two broods, June and August

References: Royer 31, Ferris & Brown 124, Scott 435

Confirmed occurrences: Not encountered. Probably does not occur at Knife River Indian Villages NHS.

Common Branded Skipper

Hesperia comma (Linnaeus, 1758)

HECO

Habitat: Prairie hilltops; very fond of *Liatris* blooms

Larval food: Native grasses and sedges

Adult flight: One brood, August

References: Royer 32, Ferris & Brown 125, Scott 436

Confirmed occurrences: Two examples encountered in prairie area at north end of site (UTM = 52494457n, 319606e). Probably common in this area in favorable years.

Ottoe Skipper

Hesperia ottoe W. H. Edwards, 1866

HEOT

Habitat: Undisturbed native prairies, often on hilltops with on *Echinacea* blooms

Larval food: Native grasses, especially *Andropogon*, *Bouteloua*; *Stipa* have all been reported

Adult flight: One brood, mid-June through early July

References: Royer 33, Ferris & Brown 128, Scott 437

Confirmed occurrences: Not encountered. Probably does not occur at Knife River Indian Villages NHS.

Pawnee Skipper

Hesperia leonardus pawnee Dodge, 1874

HEPW

Habitat: Undisturbed, often sandy native prairies on *Liatris* blooms

Larval food: Native grasses, especially *Bouteloua*; *Stipa*, *Poa* also mentioned in literature

Adult flight: One brood, early August

References: Royer 34, Ferris & Brown 128, Scott 438

Confirmed occurrences: Fairly common in prairie area at north end of site (UTM = 5249441n, 319571e).

Probably common in this area in favorable years..

Peck's Skipper

Polites peckius (W. Kirby, 1837)

POPE

Habitat: Meadows with higher humidity (often concentrated near water)

Larval food: Cutgrass (*Leersia oryzoides*), probably also *Poa*

Adult flight: One brood, mid-June into July

References: Royer 37, Opler & Krizek 232, Scott 444

Confirmed occurrences: Not encountered. Possibly occurs at Knife River Indian Villages NHS in more favorable years.

Tawny-edged Skipper

Polites themistocles (Latreille, [1824])

POTH

Habitat: Meadows and road ditches, often at alfalfa blooms

Larval food: Grasses, including *Poa*, *Panicum*

Adult flight: One brood, mid-June into July, somewhat later in 2002

References: Royer 38, Opler & Krizek 234, Scott 445

Confirmed occurrences: Not encountered. Probably occurs at Knife River Indian Villages NHS in more favorable years.

Crossline Skipper

Polites origenes (Fabricius, 1793)

POOR

Habitat: Ungrazed native prairie, *Echinacea* blooms

Larval food: Reportedly Purpletop (*Tridens flavus*); probably *Andropogon* in North Dakota

Adult flight: One brood, mid-June into July; flight was approximately two weeks late in 2004

References: Royer 39, Opler & Krizek 234, Scott 446

Confirmed occurrences: One male encountered 13 July 2004 in north prairie area (UTM = 5249365n, 319693e).

Long Dash

Polites mystic (W. H. Edwards, 1863)

POMY

Habitat: Marsh edges, wet meadows, prairies & roadside ditches

Larval food: Grasses, including *Poa*, *Agropyron*, *Phleum*

Adult flight: One brood, mid-June into July; somewhat later in 2002

References: Royer 40, Opler & Krizek 235, Scott 445

Confirmed occurrences: Uncommon to rare on 13 and 30 July on North Forest Trail.

Delaware Skipper

Atrytone logan (W. H. Edwards, 1863)

ATLO

Habitat: Open grasslands; loves thistle blooms

Larval food: Grasses, including *Andropogon*, *Panicum*, *Erianthus*

Adult flight: One brood, mid-June into July

References: Royer 45, Opler & Krizek 241, Scott 449

Confirmed occurrences: Rare on 13 and 30 July in north prairie area (UTM = 5249394n, 319626e).

Hobomok Skipper

Poanes hobomok (Harris, 1862)

POHO

Habitat: Shady woodlands with moist soil, *Hesperis*, *Apocynum*

Larval food: Grasses, including *Panicum*, *Poa*

Adult flight: One brood, June

References: Royer 48, Opler & Krizek 244, Scott 453

Confirmed occurrences: Common on 16 June 2004 to rare (flight nearing end) on 28 June and 13 July 2004, principally along North Forest Trail.

Dun Skipper

Euphyes vestris (Boisduval, 1852)

EURU

Habitat: Pastures, *Monarda* stands, lower areas in prairie

Larval food: Sedges, including various *Carex* spp., *Cyperus esculentus*

Adult flight: One brood, July

References: Royer 51, Opler & Krizek 252, Scott 456

Confirmed occurrences: Not encountered. Possibly occurs at Knife River Indian Villages NHS in more favorable years.

Roadside Skipper

Amblyscirtes vialis (W. H. Edwards, 1862)

AMVI

Habitat: Woodland roadsides, glens; fond of *Apocynum* blooms

Larval food: Grasses, including *Poa*, *Avena*, *Agrostis*

Adult flight: One brood, May and early June

References: Royer 54, Opler & Krizek 258, Scott 463

Confirmed occurrences: Not encountered. Possibly occurs at Knife River Indian Villages NHS in more favorable years.

Papilionidae The Swallowtails**Baird's Swallowtail**

Papilio bairdii W. H. Edwards, 1866

PABA

Habitat: Badlands hilltops near *Artemisia dracunculus*

Larval food: *Artemisia dracunculus*

Adult flight: Two broods, May/June and July/August

References: Royer 60, Ferris & Brown 181, Scott 164

Confirmed occurrences: Not encountered. May not breed at Knife River Indian Villages NHS.

Anise Swallowtail

Papilio zelicaon Lucas, 1852

PAZE

Habitat: Western gardens, prairie hilltops near Apiaceae

Larval food: Wild Apiaceae, possibly including *Lomatium*, *Musineon*

Adult flight: One protracted brood, May into July

References: Royer 61, Ferris & Brown 183, Scott 170

Confirmed occurrences: Not encountered. May not breed at Knife River Indian Villages NHS.

Canadian Tiger Swallowtail

Papilio (Pterourus) canadensis Rothschild & Jordan, 1906

PTCA

Habitat: Ash breaks, woodlands; often found on *Apocynum* blooms

Larval food: *Populus*, *Salix*, possibly also *Prunus*

Adult flight: One brood, early June

References: Royer 64, Opler & Krizek 49, Scott 179

Confirmed occurrences: One example encountered on 28 June 2004. Possibly more common in favorable years. Dates in site collection suggest a second brood, and individuals of this population may be referable to *Papilio glaucus*.

Pieridae The Whites and Sulphurs

Western White

Pontia occidentalis (Reakirt, 1866)

POOC

Habitat: Open prairie, especially on hilltops

Larval food: Cruciferae, including *Lepidium*, *Arabis*, *Sisymbrium*

Adult flight: Two broods, May and July

References: Royer 71, Ferris & Brown 150, Scott 222

Confirmed occurrences: Not encountered. Probably does not regularly breed at Knife River Indian Villages NHS.

European Cabbage Butterfly

Pieris rapae (Linnaeus, 1758)

ARRA

Habitat: Ubiquitous in gardens and roadsides in agricultural areas

Larval food: Cruciferae, occasionally also Capparidaceae

Adult flight: Multiple broods, May-September

References: Royer 73, Opler & Krizek 59, Scott 216

Confirmed occurrences: Fairly common to abundant on 16 and 28 June, 13 and 30 July, and 28 August 2004 throughout the site.

Clouded Sulphur

Colias philodice Godart, 1819

COPH

Habitat: Ubiquitous in agricultural areas

Larval food: Legumes, especially *Trifolium*, *Medicago* and *Melilotus*

Adult flight: Multiple broods, May-September

References: Royer 75, Opler & Krizek 64, Scott 198

Confirmed occurrences: Fairly common to abundant on 27 May, 16 June, 13 and 30 July, and 28 August 2004 throughout the site.

Orange Sulphur or Alfalfa Butterfly

Colias eurytheme Boisduval, 1852

COEU

Habitat: Common in agricultural areas, though less so than *C. philodice*

Larval food: Legumes, especially *Medicago*, also *Melilotus*

Adult flight: Multiple broods, May-September

References: Royer 76, Opler & Krizek 65, Scott 196

Confirmed occurrences: Fairly common to rare on 16 and 28 June, 13 and 30 July, and 28 August 2004 throughout the site.

Lycaenidae The Gossamer Wings

Gray Copper

Lycaena (Gaeides) dione (Scudder, 1868)

GAXA

Habitat: Prairie meadows, ditches, disturbed areas

Larval food: *Rumex obtusifolius*

Adult flight: One brood, late June through July

References: Royer 87, Opler & Krizek 83, Scott 391

Confirmed occurrences: Uncommon locally on 13 July north of the wetland in north prairie hills (at end of trail).

Bronze Copper

Lycaena (Hyllolycaena) hyllus (Cramer, 1775)

HYHY

Habitat: Open wet meadows with *Polygonum* or *Rumex*, pond margins, marshes, usually with neutral to alkaline soil pH

Larval food: *Rumex crispus*, *R. obiculatus*, *Polygonum* spp.

Adult flight: Two broods, June and August

References: Royer 88, Opler & Krizek 84, Scott 388

Confirmed occurrences: Not encountered. Probably does occur locally at Knife River Indian Villages NHS, especially in wetlands around Knife River.

Purplish Copper

Lycaena (Epidemia) helloides (Boisduval, 1852)

EPHE

Habitat: Wastelands, wet ditches, open fields; a vagile species

Larval food: *Rumex* spp., *Polygonum* spp.

Adult flight: Two broods, June and August

References: Royer 90, Opler & Krizek 86, Scott 389

Confirmed occurrences: Not encountered. Probably does occasionally occur at Knife River Indian Villages NHS, especially in wetlands around Knife River.

Acadian Hairstreak

Satyrrium acadicum (W. H. Edwards, 1862)

SAAC

Habitat: Moist areas with willow, especially also with *Asclepias*

Larval food: *Salix* spp.

Adult flight: One brood, late June into July

References: Royer 91, Opler & Krizek 90, Scott 361

Confirmed occurrences: Not encountered. May not occur at Knife River Indian Villages NHS.

Coral Hairstreak

Satyrrium (Harkenclenus) titus (Fabricius, 1793)

HATI

Habitat: Scrubby areas, especially with *Prunus*, *Crataegus* and *Asclepias*

Larval food: *Prunus* spp.

Adult flight: One brood, July, often flying into August

References: Royer 92, Opler & Krizek 89, Scott 360

Confirmed occurrences: Uncommon to fairly common around north prairie hills *Prunus* thickets on 30 July and 28 August 2004.

Striped Hairstreak

Satyrrium liparops (Le Conte, 1833)

SALI

Habitat: Oak woodlands and wooded breaks or thickets that include *Amelanchier*, *Prunus*, *Crataegus*; especially fond of *Melilotus alba*, *Gypsophila* blooms

Larval food: Rosaceae, including *Prunus*, *Crataegus*, *Amelanchier*, etc.

Adult flight: One brood, late June, July

References: Royer 95, Opler & Krizek 94, Scott 362

Confirmed occurrences: Not encountered. May occur at Knife River Indian Villages NHS in appropriate habitat during more favorable years.

Gray Hairstreak

Strymon melinus (Hübner, [1813])

STME

Habitat: Brushy, weedy, disturbed open areas; occasional

Larval food: Widely varied, including *Astragalus*, *Polygonum*, *Malva*

Adult flight: Two or three broods, May, July, September

References: Royer 100, Ferris & Brown 264, Scott 383

Confirmed occurrences: Not encountered. May be intermittent throughout the study area in some years.

Spring Azure

Celastrina ladon (Cramer, 1780)

CEAR

Habitat: Most often associated with *Amelanchier* blooms in spring

Larval food: *Prunus* in west; *Cornus*, *Viburnum*, etc., in north and east. We probably have two species in North Dakota, best differentiated by their larval hosts.

Adult flight: The western taxon is univoltine, flying only in May while *Amelanchier* and *Ribes* are in bloom.

References: Royer 104, Ferris & Brown 221, Opler & Krizek 116, Scott 396

Confirmed occurrences: Not encountered. Probably does occur at Knife River Indian Villages NHS, especially in mature woodland at south end of site.

Silvery Blue

Glaucopsyche lygdamus (Doubleday, 1841)

GLLY

Habitat: Open areas in or near woodlands

Larval food: Legumes, including *Lupinus*, *Astragalus*, *Hedysarum*

Adult flight: Widespread, late May through June, one brood only

References: Royer 105, Opler & Krizek 119, Scott 399

Confirmed occurrences: Uncommon to rare on 27 May and 16 June 2004 along North Forest Trail.

Melissa Blue

Lycaeides melissa (W. H. Edwards, 1873)

LYME

Habitat: Open prairies

Larval food: Legumes, including *Lupinus*, *Astragalus*, *Oxytropis*, *Glycyrrhiza*

Adult flight: Two broods, June and August

References: Royer 106, Ferris & Brown 202, Scott 407

Confirmed occurrences: Uncommon to fairly common on 27 May, 16 and 28 June, 13 and 30 July, and 28 August 2004. More or less restricted to the north prairie hills area at north end of site.

Nymphalidae The Brush-footed Butterflies

Subfamily **Heliconiinae** Heliconians and Fritillaries

Variegated Fritillary

Euptoieta claudia (Cramer, 1775)

EUCL

Habitat: Southern migrant, often common in open prairies

Larval food: A wide range of seemingly unrelated plant spp., including *Viola*, *Portulaca*, *Desmodium*, *Menispermum*

Adult flight: Continuous breeder arriving in May, often abundant by fall

References: Royer 119, Opler & Krizek 130, Scott 335

Confirmed occurrences: Encountered occasionally during field work in open areas.

Great Spangled Fritillary

Speyeria cybele (Fabricius, 1775)

SPCY

Habitat: Woodland margins, often nectaring *Cirsium*, *Monarda*, or *Liatris*

Larval food: *Viola* spp. (larva overwinters shortly after eclosure)

Adult flight: Late June into early August

References: Royer 120, Opler & Krizek 132, Scott 325

Confirmed occurrences: Uncommon to fairly common on 13 and 30 July and 28 August 2004 in woodland margins along North Forest Trail.

Aphrodite Fritillary

Speyeria aphrodite (Fabricius, 1787)

SPAP

Habitat: Open meadows, nectars at *Cirsium*, *Monarda*, *Liatris*; males patrol continuously when not taking nectar or resting

Larval food: *Viola* spp. (larva overwinters shortly after eclosure)

Adult flight: Late June into early August, depending on location

References: Royer 121, Opler & Krizek 133, Scott 324

Confirmed occurrences: Uncommon to fairly common on 30 July and 28 August in north prairie hills area.

Callippe Fritillary

Speyeria callippe (Boisduval, 1852)

SPCA

Habitat: Native prairies; nectars avidly at *Medicago*, *Cirsium*

Larval food: *Viola* spp. (larva overwinters in 1st stage)

Adult flight: Mid-June into July (earlier than most *Speyeria* spp.)

References: Royer 124, Ferris & Brown 307, Scott 329

Confirmed occurrences: Rare on 28 June 2004 in north prairie hills area.

Regal Fritillary

Speyeria idalia (Drury, 1773)

SPID

Habitat: Native prairies; nectars avidly at *Cirsium*

Larval food: *Viola* spp., especially *V. petadifida* (larva overwinters in 1st stage shortly after eclosure)

Adult flight: Mid-June into July (earlier than most *Speyeria* spp.)

References: Royer 122, Opler & Krizek 134, Scott 327

Confirmed occurrences: Several worn males encountered (uncommon) 30 July 2004 in north prairie hills area (UTM = 5249571n, 319476e).

Subfamily **Nymphalinae** Crescents, Checkerspots, and Anglewings

Pearl Crescent

Phyciodes tharos (Drury, 1773)

PHTH

Habitat: Sunny places, roadsides, widespread

Larval food: *Aster* spp.

Adult flight: Multiple broods; May, June-July, August-September

References: Royer 135, Opler & Krizek 145, Scott 311

Confirmed occurrences: Uncommon to rare, 27 May, 28 June and 30 July in various areas throughout site.

Comma or Hop Merchant

Polygonia comma (Harris, 1842)

POCO

Habitat: Shady woodlands, sunlit patches late afternoon; adults drink running sap and juices of rotting fruit

Larval food: *Urtica* spp., possibly also *Ulmus*

Adult flight: Overwinters as adult, appearing April-May to produce a dark-winged summer form by late June. These in turn produce a second, light-winged, overwintering brood in August.

References: Royer 139, Opler & Krizek 151, Scott 284

Confirmed occurrences: Fairly common to common throughout north forest area on 13 and 30 July 2004.

Gray Comma

Polygonia progne (Cramer, 1775)

POPG

Habitat: Deciduous woodlands, sunlit patches late afternoon; adults drink running sap and juices of rotting fruit

Larval food: *Ribes* spp.

Adult flight: Overwinters as adult, appearing April-May to produce a dark-winged summer form by late June. These in turn produce a second, light-winged, overwintering brood in August.

References: Royer 143, Opler & Krizek 154, Scott 287

Confirmed occurrences: Not encountered. May not occur at Knife River Indian Villages NHS.

Mourning Cloak

Nymphalis antiopa (Linnaeus, 1758)

NYAN

Habitat: Riparian forests; adults drink *Quercus* sap and fermenting fruit juices, and occasionally the nectar of such flowers as *Asclepias*, *Apocynum*, etc.

Larval food: *Salix* spp. primarily, but also *Populus*, *Betula*, *Ulmus*

Adult flight: Overwinters as adult, appearing April-May to produce a single annual brood by early July. Partially southward migratory; adults live nearly a year

References: Royer 146, Opler & Krizek 156, Scott 291

Confirmed occurrences: Uncommon to rare but predictably present in wooded areas on 27 May, 16 and 28 June, and 13 July 2004.

Milbert's Tortoise Shell

Aglais milberti (Godart, 1819)

AGMI

Habitat: Widespread across the state in autumn

Larval food: *Urtica* and *Salix* spp. also possibly *Helianthus*

Adult flight: Confused; one to four broods reported; probably two in ND

References: Royer 147, Opler & Krizek 157, Scott 289

Confirmed occurrences: Rare (one example) on 13 July 2004 in wooded area along North Forest Trail.

Painted Lady

Vanessa cardui (Linnaeus, 1758)

VACA

Habitat: Open prairies, roadsides and meadows

Larval food: *Cirsium* primarily; also *Helianthus*, many other composites

Adult flight: Frequent spring immigrant; does not survive winter

References: Royer 149, Opler & Krizek 159, Scott 289

Confirmed occurrences: Fairly common to rare throughout north half of site on 16 and 28 June and 28 August 2004, principally in prairie hills area.

Red Admiral

Vanessa atalanta (Linnaeus, 1758)

VAAT

Habitat: Sunlit patches in woodland clearings near nettles

Larval food: *Urtica*

Adult flight: Regular spring immigrant; does not survive winter

References: Royer 151, Opler & Krizek 160, Scott 280

Confirmed occurrences: Fairly common to abundant (depending on phenological status) on 27 May, 16 and 28 June, 13 July, and 28 August 2004 throughout north forest area.

Subfamily **Limenitidinae** Admirals

White Admiral

Limenitis arthemis (Drury, 1773)

BAAA

Habitat: Woodland breaks and clearings

Larval food: *Populus*, *Salix*, possibly also *Prunus*

Adult flight: One brood, appearing in late June through July

References: Royer 154, Layberry et al. 208, Scott 260

Confirmed occurrences: One example encountered each day on 13 and 30 July in woodland at south end of North Forest Trail.

Viceroy

Limenitis archippus (Cramer, 1775)

BAAR

Habitat: Wet meadows with willows

Larval food:, *Salix*, possibly also *Populus*

Adult flight: Two broods, appearing in June and August

References: Royer 156, Layberry et al. 208, Scott 259

Confirmed occurrences: Not encountered. Probably does occur at Knife River Indian Villages NHS in willow areas near Knife River.

Subfamily **Satyrinae** Satyrs and Wood Nymphs

Northern Pearly Eye

Enodia anthedon A. H. Clark, 1936

ENAN

Habitat: Deep woodlands, seldom far from shade

Larval food: Woodland grasses

Adult flight: One brood, primarily in July

References: Royer 162, Opler & Krizek 176, Scott 234

Confirmed occurrences: Fairly common to rare on 13 and 30 July 2004. [Encountered in two locations: UTM = 5248375n, 319948e (North Forest Trail) and 5243923n, 320495 (near Sakakawea Park).]

Eyed Brown

Satyrodes eurydice (Linnaeus, 1763)

SAEU

Habitat: Sedge meadows and marshes, seldom far from water

Larval food: Sedges

Adult flight: One brood, primarily in July

References: Royer 163, Opler & Krizek 178, Scott 235

Confirmed occurrences: Rare, three examples encountered in wetland along Knife River on 13 July (UTM = 5247000n, 320187e).

Little Wood Satyr

Megisto cymela (Cramer, 1777)

MECY

Habitat: Deep woodlands, seldom far from shade

Larval food: Woodland grasses

Adult flight: One brood, primarily in June

References: Royer 164, Opler & Krizek 184, Scott 237

Confirmed occurrences: Not encountered. Probably does occur at Knife River Indian Villages NHS in favorable years, particularly in mature woodlands at southern end of site.

Inornate Ringlet

Coenonympha inornata W. H. Edwards, 1861

COIN

Habitat: Open, grassy meadows and native prairies

Larval food: Doubtless many grass species are utilized

Adult flight: One brood, primarily in late May and June

References: Royer 165, Opler & Krizek 186, Scott 239 (as *tullia*)

Confirmed occurrences: Uncommon to very common, 16 and 28 June 2004, principally in north prairie area.

Common Wood Nymph

Cercyonis pegala (Fabricius, 1775)

CEPE

Habitat: Native prairies and grasslands

Larval food: *Andropogon*, *Stipa*; many grasses are no doubt utilized

Adult flight: One brood, primarily in July and August

References: Royer 166, Opler & Krizek 186, Scott 240

Confirmed occurrences: Common to abundant, 13 and 30 July and 28 August 2004, principally in north prairie area.

Varuna Arctic

Oeneis uhleri varuna (W. H. Edwards, 1882)

OEUH

Habitat: TL = "Plains of Dakota Territory"; well drained prairie slopes

Larval food: Unknown grass sp.

Adult flight: One brood, mid-May into June

References: Royer 171, Ferris & Brown 284, Scott 250

Confirmed occurrences: Uncommon in north prairie hills area on 27 May 2004.

Subfamily **Danainae** The Milkweed Butterflies

Monarch

Danaus plexippus (Linnaeus, 1758)

DAPL

Habitat: Widespread immigrant

Larval food: *Asclepias* spp.

Adult flight: Sparse northward immigration in spring results in multiple broods; southward fall migrations can be quite spectacular

References: Royer 174, Opler & Krizek 193, Scott 229

Confirmed occurrences: Rare to common in milkweed patches along North Forest Trail on 16 and 28 June, 13 and 30 July, and 28 August 2004.

Section III – Recommendations to Park Management

General background – The 2004 butterfly season in North Dakota was unusual in several ways. Spring emergences began approximately one week earlier than usual, with normal to above-normal butterfly numbers throughout April and May. In early June, at the beginning of the flight of many important species, several untimely freezes brought all butterfly emergences to an abrupt halt. By early July, emergence for most species was either not apparent or as much as two weeks later than normal. Consequently, hesperiine skippers, including many species that should occur in the Knife River area, were uncommon to rare throughout North Dakota. Absence of many species from survey encounter lists therefore may not mean that they do not normally occur in a study site in more normal years.

Since butterflies are essentially place-bound in all but the adult stage, endemism is an important factor to consider in prairie butterfly conservation and management. Life histories of endemic prairie butterflies typically are closely bound to very specific ecological conditions. Even adults may be intimately tied to specialized habitat demands within a given parcel. Modern management treatments must therefore be applied on a scale small enough to correspond to the scope in which the butterflies themselves operate (Kirby 1992). In many portions of the study area, this might be only a few square meters within a given habitat area. For these reasons butterflies respond quite differently to wide-scale management activities than do either plants or the larger, more motile, vertebrate taxa.

Taken together, these factors offer some indication of how easily a population may be extirpated when wide-scale management events such as controlled burning, insect control efforts, or overgrazing occur in isolated prairie remnants where repopulation from outside is unlikely. Many of the more sensitive species endemic or potentially linked to the study area may be said to fall into this category.

Survey of Knife River butterfly niches -- To help managers deal with this habitat specialization, Swengel (1996) has organized prairie butterflies into four groups related to niche breadth as follows:

- a) *specialists* -- prairie obligates with unique habitats
- b) *grassland* species -- those unique to grasslands but more widespread in occurrence
- c) *generalists* -- those which also occur in habitats outside the grassland environment, and

- d) *invaders* -- widespread and vagile species most likely to repopulate disturbed situations where other butterflies have been eliminated.

It is clear that none of North Dakota's "sensitive" species could be considered an *invader* into Knife River Indian Villages NHS. Most species that this study has demonstrated do occur within the site are probably best considered *generalists*. Their distribution is not restricted within the site beyond that of nectar sources and the broadest of habitat requirements (woodland vs. prairie, etc.). Those specialist butterflies that do occur at Knife River Indian Villages NHS are either limited to woodland habitat in the northern half of the site and in the extreme southern end adjacent to Sakakawea Park in Stanton (most notably the Northern Pearly Eye), or they are to be found in the far northern reaches of the native prairie segments west of the woodlands (e.g., Regal Fritillary and Crossline Skipper).

Some general management observations in these contexts –

Butterfly diversity and abundance offer clear indication of the health of the prairie environment. Any management that would diminish either butterfly diversity or butterfly abundance should be avoided. In the study area, the primary disturbances are three:

- 1) There is clear evidence of a history of wide-scale controlled burning in the southern half of the site (Two Rivers Trail) that has essentially eliminated butterfly populations there. Given that all adjacent lands are agricultural, there has been no opportunity for natural reintroduction of any native species, and this area was essentially devoid of butterflies throughout the study.
- 2) Management of the prairie immediately north and west of the North Forest Trail has become severely degraded (invasion of Brome grass and wormwood), especially near the margins of the site. Efforts to minimize further degradation will be essential to sustaining populations of prairie *specialist* butterflies that are still found there.
- 3) Efforts to clear debris from the woodland habitat of the North Forest Trail may interfere with health of much of the herbaceous growth there that is necessary for sustenance of several woodland species (e.g., Northern Pearly Eye and Red Admiral).

Three facts, namely (a) that there is currently insufficient intact habitat for prairie *specialist* butterflies which require native forbs as well as native grasses, (b) that there is ample stable woodland habitat for

native sciophilic butterfly species, and (c) that there were essentially no butterflies evident throughout the southern half of the study area during most of the survey period, suggest that a comprehensive butterfly (ideally an invertebrate) management plan is sorely needed for Knife River Indian Villages NHS in order to reestablish and sustain an invertebrate biota similar to that predating European settlement. This plan should include efforts to protect and expand the native prairie segment in the northwestern part of the site, to sustain the health of the woodlands in the northern and far southern portions of the site (this should not include wholesale removal of deadfall or other understory growth), and resurrection of the grassland habitat (particularly the broad-leaf flora) in the southern half, where a burning rotation should be carefully segmented into smaller partial burn units.

Unlike megafauna, whose dependencies are not related so essentially to such particular microhabitat characteristics as *specialist* butterflies require, native butterfly species depend exclusively on microhabitats that include healthy representation of the above-outlined habitats. The degree to which the balance and diversity among native grasses and woodland forb species in remaining habitat remnants within the study area are "disturbed," particularly by continuous burning, will ultimately be the deciding factor in survival of these butterflies within Knife River Indian Villages NHS.

Recommendations for Continued Monitoring -- The hypothetical list of potential species found in table 1 led to confirmation of the occurrence many resident species during the survey. A few other suspected breeding residents or regular immigrants are also included in this list since it is deemed likely on the basis of field assessment that they will likely be confirmed at some time in the future.

For continued monitoring, and because it is nearly impossible to establish abundance for any resident species in a single season over such an extensive area, it is recommended that Knife River Indian Villages NHS be surveyed regularly throughout at least one full day during each of three periods of a given survey year: 1) the first three weeks of June, 2) late June through the first half of July, and 3) during the middle of August. For consistency with other North Dakota butterfly survey efforts, the following basic protocols are recommended:

- *The sampling day should extend from approximately 9 am until not later than 5 pm.*

- *Butterflies should be recorded with encoded four-letter acronyms (see individual species listings) used by the author of this report in statewide database management.*
- *A walking pace should be steady and regular at approximately 35 meters per minute.*
- *Only butterflies actually seen within an estimated 2.5 meters on either side of the surveyor, within 5.0 meters of the ground, and 5.0 meters to the front should be counted*

Vouchers Collected and Repository

Very few specimens were collected during the course of this inventory. Those that were are all on deposit in the collection at the park.

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